

graphics, as suggested at **85**; a null field **86**; bar codes, etc. Whichever system is involved in each field is identified in component **82** and, in addition, component **80** carries the marks like marks **19** for locating the synch lines. Again, frame component **82** includes four strips making up the inner layer of the frame.

Individual strips forming sides of each of the frame components are shown in FIGS. **13**, **14** and **15** in foreshortened form. The leading and trailing ends of each of the frame components include white and black sections which form an orientation code as discussed in connection with FIG. **2**. The frames are read in the tracing process mentioned above in which the component is read along its axis, starting at either end, along a line **88** which is not actually part of the frame and is included in the figures only to show the path and direction along which the frame is traced. The color transitions (black/white) yield width measurements which give the orientation and system information.

Tracing a calibration strip, as shown in FIG. **13**, involves the following process in which the numbers correspond to those on the figure.

1. Move up to the beginning of the frame from the outside at one end which locates the beginning of the strip.
2. Move to the approximate center of the first square; at this point the color of the initial square is known.
3. proceed to the next color transition, giving the width of the component strip.
4. proceed to the next color transition, giving the width of the frame perpendicular and the beginning of the calibration pattern. Repeat 1, 2, 3 and 4 at the other end; then
5. Proceed through the calibration pattern, giving feedback information for calibration.

Tracing the other frame component strips:

1. Move to the beginning of the frame from the outside at one end, giving the beginning location.
2. Proceed to the approximate center of the first square which gives color information.
3. Proceed to the next color transition which gives the width of the frame perpendicular.
4. Proceed to the next transition which is the beginning of the data. Repeat at the other end, if necessary; then
5. Proceed through the data.

These tracing processes will yield the following information:

- a. Pattern orientation (with redundancy),
- b. width of frame component strip (with redundancy),
- c. width of frame line perpendicular (with redundancy), and
- d. the data obtained from the strip.

While the invention has been discussed in terms of printing the data arrays on paper, and while that is regarded as being an especially useful format for the invention, it should be recognized that it is not the only format. Film and other media are also usable with the invention and the areas of light and dark can be reversed if that is more convenient in a particular medium.

While certain advantageous embodiments have been chosen to illustrate the invention, it will be understood by those skilled in the art that various changes and modifications can be made therein without departing from the scope of the invention as defined in the appended claims.

What is claimed is:

1. A method for graphically representing binary data in a

condensed, high-density, machine-readable form, comprising the steps of

forming a pattern of information-carrying graphic elements defining a geometric reference system, the reference system including a substantially continuous frame having a selected width and a plurality of synchronization lines within the frame defining boundaries of at least one data field;

placing a plurality of machine-readable marks within the width of the frame identifying the pattern as a data-field reference system and providing information about data to be included in the system, and

substantially filling the at least one data field with a plurality of binary data-transmission elements each characterized by the presence or absence of a machine-readable mark at each of a plurality of contiguous binary data element locations, each binary data element location having a known geometric relationship to the reference system so that coordinates of each of the plurality of individual binary data elements can be accurately determined.

2. A method according to claim 1, wherein the synchronization lines define a plurality of fields and wherein the method includes the step of selecting an arrangement for said fields relative to each other and shaping the frame to surround the selected arrangement of fields.

3. A method according to claim 2 wherein the synchronization lines are orthogonal.

4. A method according to claim 2 and including forming the synchronization lines with edges which repetitively and substantially linearly diverge and converge relative to each other.

5. A method according to claim 2 and including forming the synchronization lines with stepped edges.

6. A method according to claim 2 and including incorporating in the machine-readable marks within the width of the frame information describing the type of binary data carried by the elements and defining orientation thereof to indicate a beginning location of the reference system.

7. A method according to claim 6 wherein the binary data-transmission elements are arranged in the field in a selected geometric format, the method including incorporating in the machine-readable marks within the width of the frame information describing the geometric format of the binary data-transmission elements.

8. A method of transporting binary data comprising the steps of

printing the binary data graphically on a medium in a condensed, high-density, machine-readable form by

forming a plurality of first information-carrying and pattern-organization graphic elements to provide a geometric reference system from which the coordinates of each of a plurality of individual binary data element locations can be derived mathematically, and

substantially filling a selected region in the reference system with a plurality of binary data-transmission elements at the locations, each element being characterized by the presence or absence of a machine-readable mark, the binary data element locations having known relationships to said first elements;

transporting the medium;

optically scanning the medium and forming a bit map of the pattern including the first and binary data elements, evaluating the first elements to determine the orientation and locations of the binary data elements, and